Amendments to the Claims

This listing of claims will replace all prior versions, and listings of claims, in the application:

Listing of Claims:

Claim 1. (Currently amended) An antenna diversity system for receiving frequency-modulated (FM) radio signals in an FM receiver with the phase-controlled summation of antenna signals, for motor vehicles having a multi-antenna system ~~(21)~~ with antenna switches ~~(5a, 5b...)~~ coupled to antennas ~~(A_1, A_2...A_n)~~ for producing at least two antenna output signals ~~(23a, 23b)~~, comprising:

a receiver ~~(4)~~ having a first input ~~(31)~~ and a second input ~~(32)~~ coupled respectively to the at least two antenna signals ~~(23a, 23b)~~;

a phase-shifter ~~(33)~~ having its input coupled to said second input ~~(32)~~ of said receiver ~~(4)~~, whereby the received antenna output signal ~~(23b)~~ at said second input ~~(32)~~ has the

same phase at the output of said phase shifter ~~(33)~~ as the antenna signal ~~(23a)~~ in the first receiver input ~~(31)~~;

a summation circuit ~~(35)~~ for adding up the two received antenna signals ~~(23a, 23b)~~ in a phase-coincident manner, to produce at its output, an added-up signal ~~(37)~~, to be supplied to the frequency demodulator of the FM receiver;

a phase controller ~~(34)~~, having its input coupled to the output signal ~~(37)~~ of said summation circuit ~~(35)~~, and having its output coupled to said phase shifter ~~(33)~~, said controller ~~(34)~~ having a low pass filter to limit its speed of shifting of said phase shifter ~~(33)~~;

an interference detector ~~(10)~~ having its input coupled to the output ~~(37)~~ of said summation circuit ~~(35)~~ for rapidly detecting a reception disturbance in said added-up signal ~~(37)~~ caused by a swing in the frequency of the received FM signals, so as to produce an interference detection signal ~~(30)~~ at the output of said detector ~~(10)~~; and

a controllable logic switch ~~(11)~~ having its output coupled to the antenna switches ~~(5a, 5b...)~~ of said antenna system ~~(21)~~, and its input coupled to said interference detector ~~(10)~~ so that when a received signal that is different in terms of diversity, is supplied to at least one of said two inputs ~~(31, 32)~~ of said receiver ~~(4)~~ from each of the different switching positions of the antenna switches ~~(5a, 5b...)~~ said interference detector ~~(10)~~ will actuate said logic switch ~~(11)~~ and thus switch said antenna switches ~~(5a, 5b...)~~ to another switching position, during the presence of a reception disturbance so that the output signal ~~(37)~~ fed to the FM demodulator is free of reception interference.

Claim 2. (Currently amended) The antenna diversity system according to claim 1, further comprising a plurality of reversing switches ~~(8a, 8b . . . .)~~ coupled to the input of the antenna switches ~~(5a, 5b)~~ respectively, and wherein said controllable logic switch ~~(11)~~ further comprises a list containing a preset advantageous line-up of the switching positions of the antenna selector switches ~~(5a, 5b . . . .)~~ and the reversing switches ~~(8a, 8b . . . .)~~ filed in a memory on said controllable logic switching device ~~(11)~~, so that in the event an interference in said added

up signal ~~(37)~~ is indicated, another received signal ~~(23)~~ is supplied with minimal reversing time in an alternating manner, first to the one of the two signal paths ~~(31, 32)~~, and supplied in the presence of a successively following interference indication to the other of the two signal paths ~~(31, 32)~~.

Claim 3. (Currently amended) The antenna diversity system according to claim 1, further comprising a signal evaluation processor ~~(26)~~ having its input coupled to the output of said summation circuit ~~(35)~~, said processor containing said interference detector ~~(10)~~, a timing member ~~(27)~~ for determining the time intervals TS between successive interference indications, and a logic circuit ~~(14)~~ wherein the time intervals TS are compared in said logic circuit ~~(14)~~ with the build up time TE of the phase-controller ~~(34)~~ so that in the event the build-up time falls short of a suitably preset build-up time TAPS one or more times, said build-up time being selected shorter, or not substantially longer than the build-up time TE, a reversing command signal P-S is generated by said evaluation processor ~~(26)~~ for reversing from the phase mode to the scanning mode.

Claim 4. (Currently amended) The antenna diversity system

according to claim 3, wherein with said reversing command signal p-s for reversing from the phase mode to the scanning mode, a phase-setting signal (25) is generated in said logic circuit ~~(14)~~ for turning off said phase controller ~~(34)~~ and for fixing said phase shifter ~~(33)~~ to a value that is constant in time and if an interference is indicated by the interference detector ~~(10)~~, another received signal ~~(23)~~ is allocated to at least one of said two signal paths ~~(31, 32)~~ via an address signal ~~(39)~~ generated by said logic circuit ~~(14)~~ and supplied to the logic switch ~~(11)~~, and wherein the system operates in the scanning mode.

Claim 5. (Currently amended) The antenna diversity system according to claim 4, wherein for operating in the scanning mode, the same received signal ~~(23)~~ is supplied via said logic circuit ~~(14)~~ to both signal paths ~~(31, 32)~~, and said phase shifter ~~(33)~~ is adjusted in a fixed manner so that an in-phase superimposition of the signals from the signal paths ~~(31, 32)~~ is present in said summation circuit ~~(35)~~.

Claim 6. (Currently amended) The antenna diversity system according to claim 4, wherein for operating in the scanning mode, the time intervals between successive interference indications in

said logic circuit ~~(14)~~ are continually registered and associated with the switching positions in the multi-antenna system ~~(21)~~ in a table, and that said table for continuously updating a priority list is sorted according to decreasing time intervals TS, and that when an interference is indicated by the interference detector ~~(10)~~, said logic circuit ~~(14)~~ is reversed via an address signal ~~(39)~~ to another received signal ~~(23)~~ with the highest or a higher priority.

Claim 7. (Currently amended) The antenna diversity system according to claim 6, additionally comprising a signal path selector ~~(15)~~ having both signal paths ~~(31, 32)~~ and the added-up signal path ~~(37)~~ connected on the input side, and wherein said interference detector ~~(10)~~ is connected on the output side, and further comprising a clock ~~(29)~~ disposed in said logic circuit ~~(14)~~, said clock switching the signal path selector ~~(15)~~ through to said interference detector ~~(10)~~ for testing the signal paths one at a time over a test time ~~(30)~~ required for indicating disturbances in said interference detector ~~(10)~~.

Claim 8. (Currently amended) The antenna diversity system according to claim 7, wherein for operating in the scanning mode,

said summation circuit ~~(35)~~ is supplied with only one received signal ~~(23)~~ or one of the two signal paths 1 and 2 ~~(31, 32)~~ by opening a signal path switch ~~(16)~~ located in signal path 2 ~~(32)~~ upstream of the summation circuit ~~(35)~~, wherein said logic circuit ~~(14)~~ in association with said clock ~~(29)~~ provides in successive cycle periods, that a priority list with respect to the interference purity of the received signals such as the first signal ~~(23b)~~ is always available in an updated form by reversing the signal path selector ~~(15)~~ between the two signal paths ~~(31 and 32)~~ in association with the sequential switching-on of different first received signals ~~(23b)~~ by said logic circuit ~~(14)~~, and wherein, with said signal path selector ~~(15)~~ being set to the added-signal path ~~(13)~~, and with an interference being present in said path, said summation circuit ~~(35)~~ is supplied via said logic circuit ~~(14)~~ with a different received signal ~~(23a)~~ with the highest or a higher priority, the different received signal being known in the priority list present in said logic circuit ~~(14)~~.

Claim 9. (Currently amended) The antenna diversity system according to claim 8, wherein when the preset switching time TASP is exceeded one or more times in the scanning mode, wherein said

switch on time is selected to be at least as long, or substantially longer than the build-up time TE, a reversing command signal S-P is generated for reversing from the scanning mode to the phase mode.

Claim 10. (Currently amended) The antenna diversity system according to claim 9, wherein in the event of the occurrence of a reversing command signal S-P for reversing from the scanning mode to the phase mode, said phase controller ~~(34)~~ is closed by the phase-setting signal ~~(25)~~ of said logic circuit ~~(14)~~, and said signal path switch ~~(16)~~ is closed by a signal of said logic circuit ~~(14)~~, wherein a received signal with the highest or a high priority is selected for the associated signal path such as the signal path ~~(32)~~ by an address signal ~~(30)~~ and by the setting of said switching device ~~(11)~~ resulting from such an address signal.

Claim 11. (Currently amended) The antenna diversity system according to claim 9, wherein said detector ~~(18)~~ comprises a first interference detector ~~(18a)~~ having an extremely rapid interference indication and connected to indicate disturbances in said added-up signal 37 and a second interference detector ~~(18b)~~

having superior resolution and connected to said signal path selector ~~(15)~~, cycled between the two signal paths 1 and 2 ~~(31, 32)~~, whereby the signals ~~(10)~~ indicating interference are supplied in an alternating manner for both signal paths 1 and 2 ~~(31, 32)~~ from the output of said signal path selector ~~(15)~~ to said logic circuit ~~(14)~~, with good resolution of their quality.

Claim 12. (Currently amended) The antenna diversity system according to claim 11, further comprising a third interference detector ~~(10c)~~, and wherein for the purpose of permanent availability of the interference-indicating signals ~~(10)~~, said separate interference detectors ~~(10b, 10c)~~ with superior resolution are provided for each of the two signal paths 1 and 2 ~~(31, 32)~~, respectively.

Claim 13. (Currently amended) The antenna diversity system according to claim 12, wherein said receiving device ~~(1)~~ is a superheterodyne receiver, and said phase-shifter ~~(33)~~, said summation circuit (35) and said interference detector ~~(10)~~ or the interference detectors ~~(10a, 10b, 10c)~~ are provided at the level of the intermediate-frequency (IF) of said FM receiver.

Claim 14. (Currently amended) The antenna diversity system according to claim 13, wherein said superheterodyne receiver comprises an I- and a Q-frequency shifter for generating the in-phase and the quadrature components of the intermediate-frequency received signals ~~(23)~~ in the signal paths 1 and 2 ~~(31, 32)~~ with separate weighing of the I Q components, for setting the phase via a phase-shifter member ~~(33)~~ with said phase controller ~~(34)~~ having TP-characteristics, and wherein said summation circuit ~~(35)~~ comprises a plurality of summing circuits for combining each of the I-Q components for generating the complete, frequency-modulated intermediate-frequency (IF) signal for the rapid detection of disturbances in said operating interference detector ~~(10)~~.

D3

Claim 15. (Currently amended) The antenna diversity system according to claim 14, further comprising a digital signal processor DSP ~~(41)~~ for receiving the digitized I- and Q-components on the output of the added-up signal path ~~(43)~~ for further processing.

Claim 16. (Currently amended) The antenna diversity system according to claim 14, further comprising frequency shifters

~~(44a, 45a, 44b, 45b)~~ coupled to signal paths 1 and 2 ~~(31, 32)~~ for providing digitized I- and Q-components on their outputs and coupled to said digitally operating signal processor DSP ~~(41)~~ so that reception disturbances are processed in the system by digital signal processing methods.

Claim 17. (Currently amended) The antenna diversity system according to claim 14, wherein the build up time of said controller ~~(34)~~ is adequately short for fast vehicle driving, but not excessively short in order to avoid an audible swing in the frequency of the interference, and is preferably selected in the order of magnitude of TE-20 ms to 50 ms, and the preset switch-on time TASP serving in the scanning mode as the criterion for triggering the electric reversing command S-P for reversing from the scanning mode to the phase mode, preferably from 5 to 10 times the value of TE; and the preset switch-on time TAPS serving in the phase mode as the criterion for triggering the electric reversing command P-S for reversing from the phase mode to the scanning mode preferably is from 5 to 10 times the value TE.

Claim 18. (Currently amended) The antenna diversity system according to claim 14, wherein said first interference detector

~~(10a)~~ having extremely rapid indication provides an interference indication within 50 .mu.s, due to the filter running time, and less than 100 .mu.s, and said second and third interference detectors ~~(16b, 10c)~~ with superior resolution provide an interference indication within 1 ms to 5 ms, due to filter running time.

Claim 19. (Currently amended) The antenna diversity system according to claim 18, wherein the test time ~~(30)~~ is as short as possible, and is selected between the time period required by the interference detector ~~(10a)~~ with extremely rapid indication for indicating an interference, and twice as long as said time period.

Claim 20. (Currently amended) The antenna diversity system according to claim 19, wherein said phase-shifter ~~(33)~~ is set in the phase mode so that the signal-to-noise ratio is maximal at any time.

Claim 21. (Currently amended) An antenna diversity system for receiving frequency-modulated (FM) radio signals having a multi antenna system ~~(21)~~ with antenna switches ~~(5a, 5b...)~~

coupled to antennas ~~(A_1, A_2...A_n)~~ for producing at least two antenna output signals ~~(23a, 23b)~~, comprising:

a means for shifting ~~(31)~~ the phase of at least one antenna output signal and summing ~~(35)~~ the appropriately phased antenna output signals resulting in an added-up signal; and

a detector for detecting ~~(13)~~ reception disturbances in said added-up signal and actuating the antenna switches ~~(5a, 5b...)~~ in response to a reception disturbance so as to select such a switching position in which the output signal ~~(37)~~ for the FM receiver is free of interference.

Claim 22. (Currently amended) The antenna diversity system of claim 21 further comprising a means ~~(34)~~ for limiting the speed of said means for shifting ~~(33)~~ the phase of at least one antenna output signal.

Claim 23. (Currently amended) The antenna diversity system of claim 21 wherein said detector comprises a means for switching ~~(11)~~ said antenna switches ~~(5a, 5b...)~~ through a logic switch

that actuates said antenna switches ~~(5a, 5b...)~~ during a reception disturbance.

Claim 24. (Currently amended) The antenna diversity system of claim 21 wherein said means for shifting ~~(33)~~ the phase of at least one antenna output signal ~~are characterized in that~~ is such that said antenna output signals resulting in said added-up signal are identically phased.

Claim 25. (Currently amended) The antenna diversity system of claim 21, wherein said means for shifting ~~(33)~~ the phase of at least one antenna output signal comprises a phase control means to adjust the phase of said means for shifting ~~(33)~~ the phase for creating a maximum signal-to-interference ratio in the added-up signal (37).

Claim 26. (New) An antenna diversity system for receiving frequency-modulated (FM) radio signals in an FM receiver with the phase-controlled summation of antenna signals, for motor vehicles having a multi-antenna system with antenna switches coupled to antennas for producing at least two antenna output signals, comprising:

a receiver having a first input and a second input coupled respectively to the at least two antenna signals;

a phase-shifter having its input coupled to said second input of said receiver whereby the received antenna output signal at said second input has the same phase at the output of said phase shifter as the antenna signal in the first receiver input;

a summation circuit for adding up the two received antenna signals in a phase-coincident manner, to produce at its output, an added-up signal, to be supplied to the frequency demodulator of the FM receiver;

D3

a phase controller having its input coupled to the output signal of said summation circuit, and having its output coupled to said phase shifter controller having a low pass filter to limit its speed of shifting of said phase shifter so that no audible disturbing frequency swing can occur within the operating range of said phase controller;

an interference detector having its input coupled to the output of said summation circuit for rapidly detecting a reception disturbance in said added-up signal caused by a swing in the frequency of the received FM signals, so as to produce an interference detection signal at the output of said detector; and

a controllable logic switch having its output coupled to the antenna switches of antenna system, and its input coupled to said interference detector so that when a received signal that is different in terms of diversity, is supplied to at least one of said two inputs of said receiver from each of the different switching positions of the antenna switches detector will actuate said logic switch and thus switch antenna switches to another switching position, during the presence of a reception disturbance so that the output signal fed to the FM demodulator is free of reception interference.

27. (New) The antenna diversity system as in claim 26, wherein the time period for the changes of the phases of antenna signals is in the order of 1 to 20 ms.